Willimantic River Watershed Summary

Willimantic River, Eagleville Brook, and Cedar Swamp Brook

Watershed Description and Maps

The Willimantic River watershed covers an area of approximately 32,774 acres in northeastern Connecticut (Figure 1). There are multiple municipalities located at least partially in the watershed, including Ellington, Willington, Tolland, Coventry, Windham, Stafford, and Mansfield, CT.

The Willimantic River watershed includes three segments, Willimantic River (CT3100-00_06), Eagleville Brook (CT3100-19_02), and Cedar Swamp Brook (CT3100-08_01), impaired for recreation due to elevated bacteria levels. These segments were assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of some of the other waterbodies in the watershed (CT DEEP, 2010).

Impaired Segment Facts

Impaired Segments, Lengths (miles), and Water Quality Classifications:

1. Willimantic River (CT3100-00_06); 0.4; B
2. Eagleville Brook (CT3100-19_02); 1.67; A
3. Cedar Swamp Brook (CT3100-17_03); 0.61; A

Towns: Stafford and Mansfield

Designated Use Impairments: Recreation

Sub-regional Basin Name and Code: Willimantic River, 3100

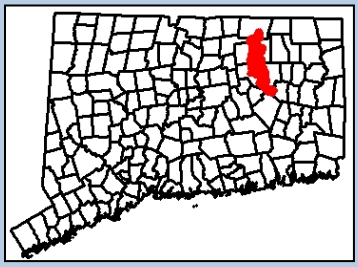
Regional Basin: Willimantic River

Major Basin: Thames

Watershed Area (acres): 32,774

MS4 Applicable? No

Figure 1: Watershed location in Connecticut



The Willimantic River (CT3100-00_06) begins in Stafford adjacent to Route 32 at the confluence of the Middle River and Furnace Brook, flows south and parallel to Route 32, and ends just upstream of the Stafford Publicly Owned Treatment Works (POTW). The impaired segment of the Willimantic River is 0.4 miles long and is located entirely within the Town of Stafford (Figure 2). Eagleville Brook (CT3100-19_02) begins on the University of Connecticut's Campus in Mansfield, flows southeast, and ends at the confluence with King's Brook just east of North Eagleville Road. This impaired segment is 1.67 miles long and is located entirely within the Town of Mansfield (Figure 3). Cedar Swamp Brook (CT3100-17_03) begins at the outlet to Swamp Brook Pond just north of US Route 44 in Mansfield, flows southwest through residential neighborhoods, and ends just upstream of the Hunting Lodge Road crossing in Mansfield. This impaired segment is 0.61 miles long and is located entirely within the Town of Mansfield (Figure 3).

The impaired segment of the Willimantic River (CT3100-00_06) has a water quality classification of B. Its designated uses include habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. The impaired segments of Eagleville Brook (CT3100-19_02) and Cedar Swamp Brook (CT3100-17_03) have a water quality classification of A. Designated uses include potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, and industrial and agricultural water supply. These segments are impaired due to elevated bacteria concentrations, affecting the designated use of recreation. As there are no designated beaches in these

impaired segments of the Willimantic River, Eagleville Brook, or Cedar Swamp Brook, the specific recreation impairment is for non-designated swimming and other water contact related activities.

Table 1: Impaired segments and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT3100-00_06	Willimantic River-06	From Stafford POTW (east of Route 32 (River Road)), US to headwaters at confluence of Middle River and Furnace Brook.	0.40	FULL	NOT	FULL
CT3100-19_02	Eagleville Brook-02	From confluence with Kings (Roberts) Brook (east side of North Eagleville Road), US to headwaters near UConn campus (just crossing Stadium Road), Mansfield.	1.67	NOT	NOT	FULL
CT3100-17_03	Cedar Swamp Brook (Mansfield)-03	From Hunting Lodge Road crossing, US to Swamp Brook Pond outlet dam (just US of Route 44 crossing), Mansfield.	0.61	U	NOT	FULL

Shaded cells indicate impaired segment addressed in this TMDL

FULL = Designated Use Fully Supported

NOT = Designated Use Not Supported

U = Unassessed

Figure 2: GIS map featuring general information of the Willimantic River watershed at the sub-regional level – Showing the Willimantic River impaired segment

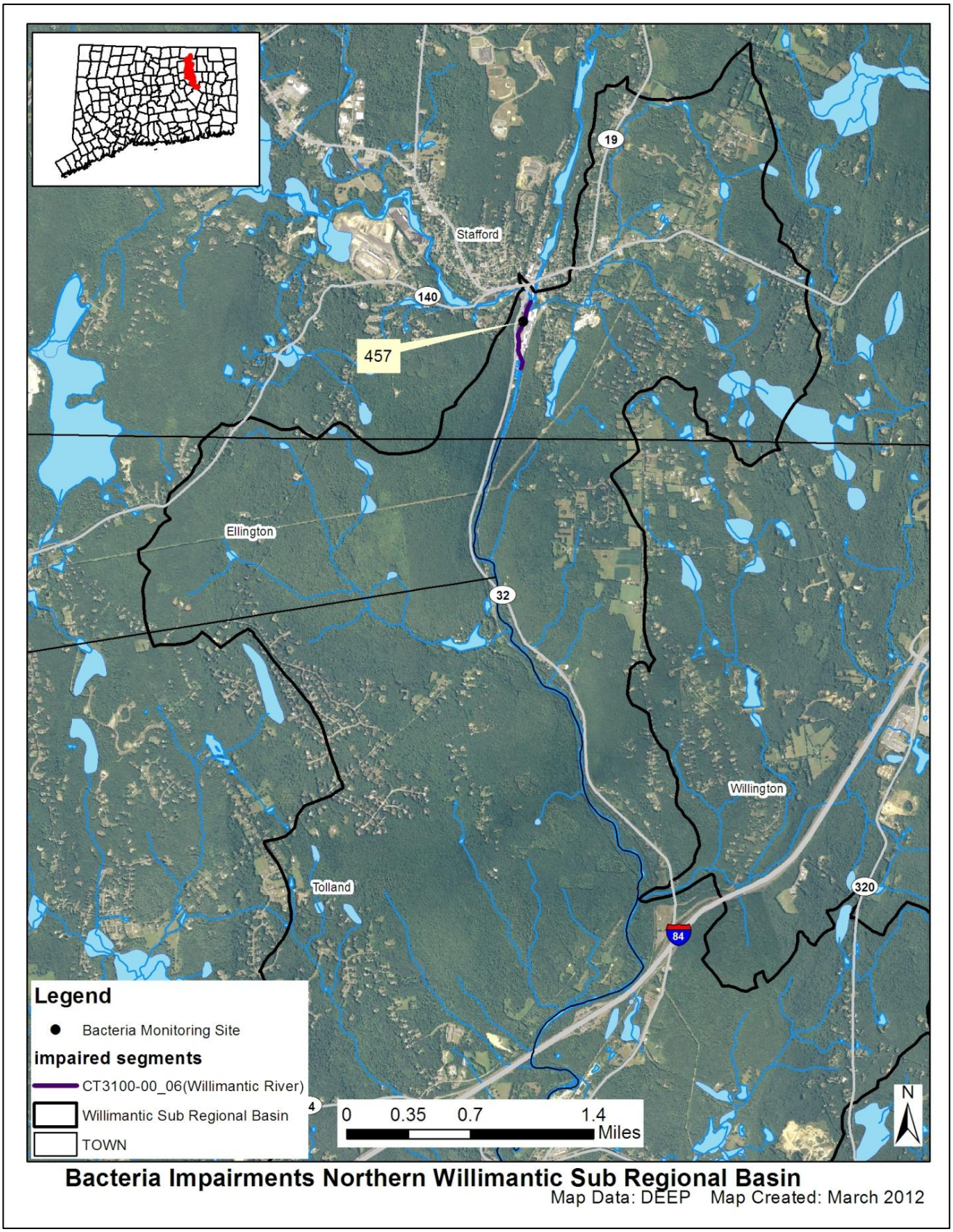
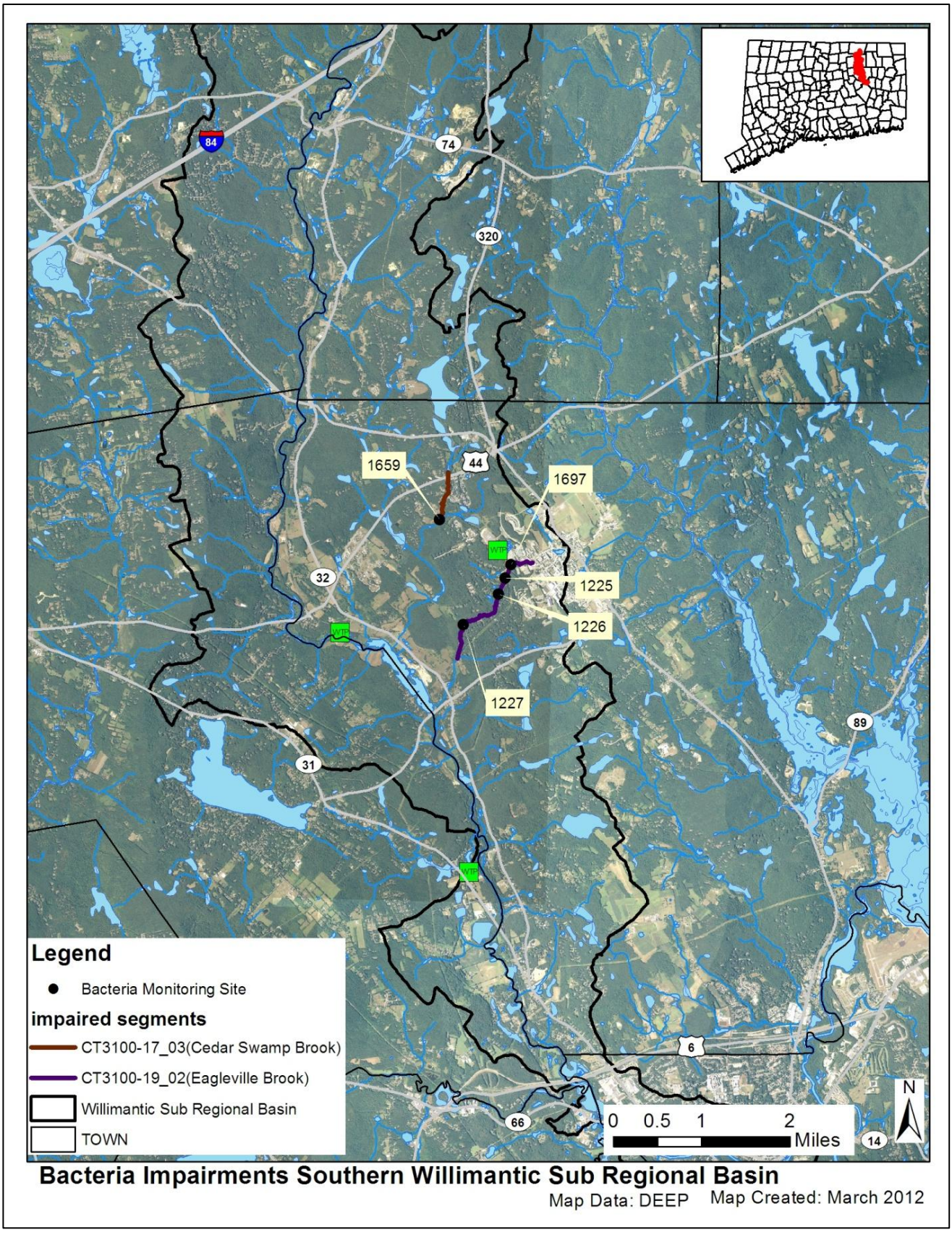


Figure 3: GIS map featuring general information of the Willimantic River watershed at the sub-regional level – Showing Eagleville Brook and Cedar Swamp Brook impaired segments



Land Use

Existing land use can affect the water quality of waterbodies within a watershed (USEPA, 2011c). Natural processes, such as soil infiltration of stormwater and plant uptake of water and nutrients, can occur in undeveloped portions of the watershed. As impervious surfaces (such as rooftops, roads, and sidewalks) increase within the watershed landscape from commercial, residential, and industrial development, the amount of stormwater runoff to waterbodies also increases. These waterbodies are negatively affected as increased pollutants from failing and insufficient septic systems, oil and grease from automobiles, and sediment from construction activities become entrained in this runoff. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 4, 5, and 6, the Willimantic River watershed consists of 63% forest, 24% urban area, 5% water, and 8% agriculture. All three of the impaired segments are surrounded by urban-dominated landscapes, particularly the Willimantic River (CT3100-00_06) in Stafford (Figures 5 and 6). Eagleville Brook and Cedar Swamp Brook are characterized by a mix of urban and forested land use in Mansfield. There are also several agricultural operations identified near the downstream terminus of Eagleville Brook in Mansfield off North Eagleville Road.

Figure 4: Land use within the Willimantic River watershed

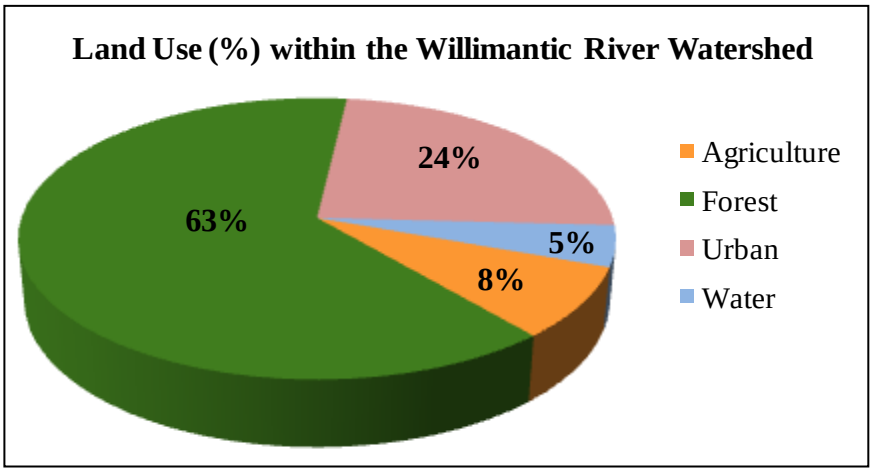


Figure 5: GIS map featuring land use for the Willimantic River watershed at the sub-regional level showing the Willimantic River impaired segment

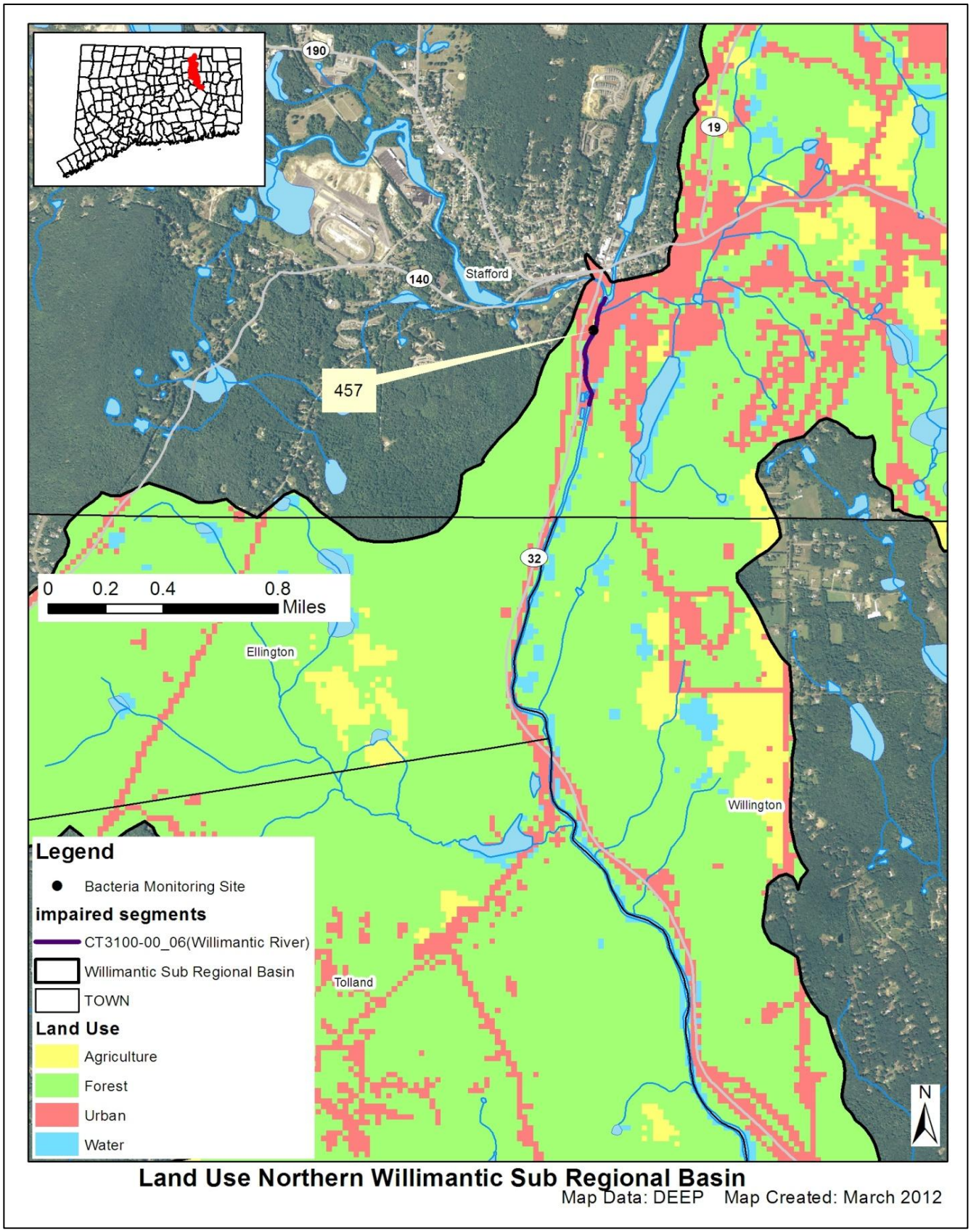
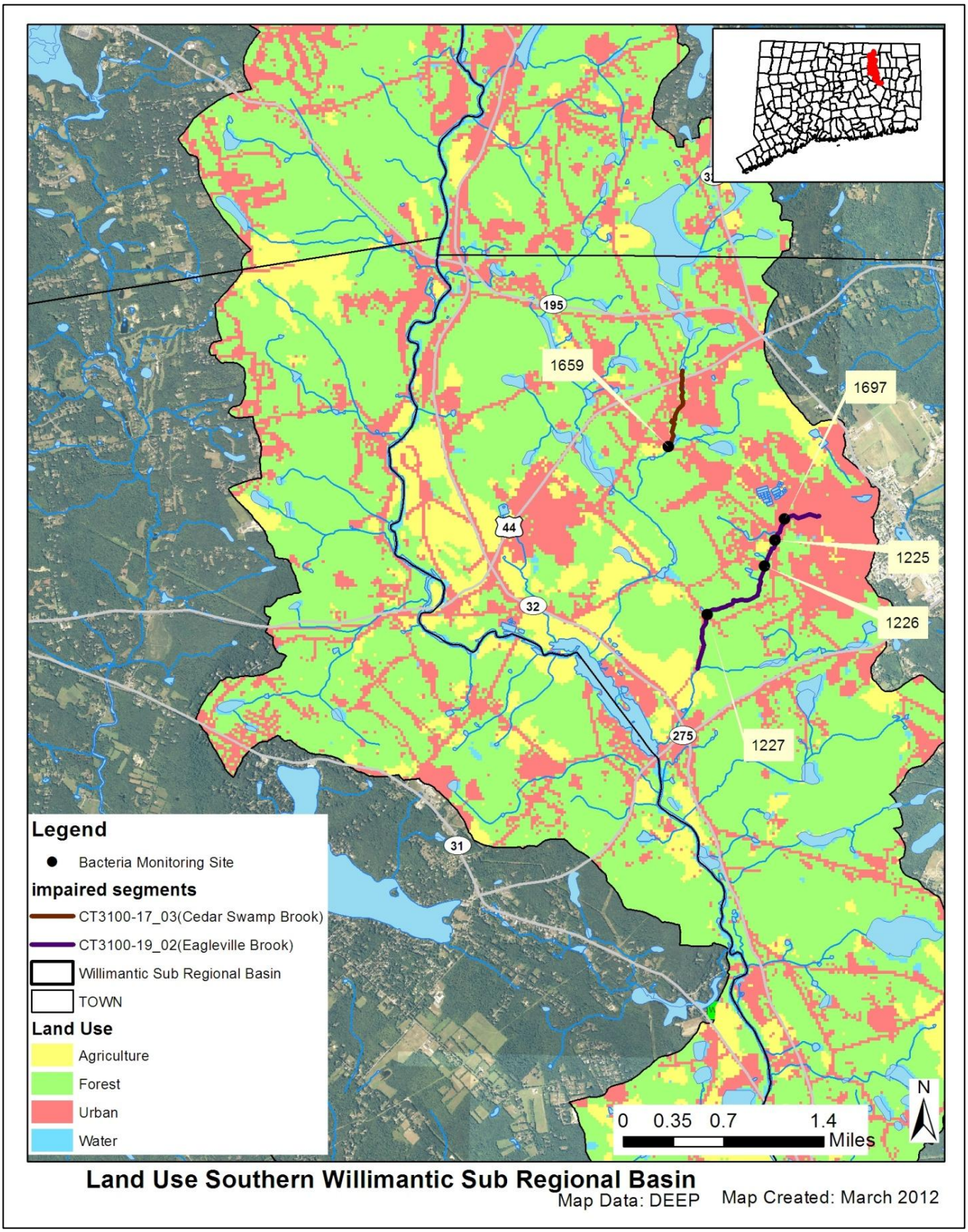


Figure 6: GIS map featuring land use for the Willimantic River watershed at the sub-regional level showing the Eagleville Brook and Cedar Swamp Brook impaired segments



WHY IS A TMDL NEEDED?

E. coli is the indicator bacteria used for comparison with the CT State criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired segments.

Table 2: Sampling station location description for impaired segments in the Willimantic River watershed

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT3100-00_06	Willimantic River	457	Upstream Stafford POTW adjacent to park	Stafford	41.95049	-72.303653
CT3100-19_02	Eagleville Brook	1227	Upstream of Hillyndale Road	Mansfield	41.79908	-72.273817
		1226	Upstream of Separatist Road	Mansfield	41.80401	-72.266044
		1225	#43 Hunting Lodge Road (private driveway)	Mansfield	41.80668	-72.264592
		1697	N Eagleville Road adjacent to F-lot	Mansfield	41.80888	-72.263319
CT3100-17_03	Cedar Swamp Brook	1659	Upstream of Hunting Lodge Road	Mansfield	41.81637	-72.278984

The Willimantic River (CT3100-00_06) is a Class B freshwater river (Figure 7). Its applicable designated uses are habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Eagleville Brook (CT3100-19_02) and Cedar Swamp Brook (CT3100-17_03) are Class A freshwater streams (Figure 7). Their applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from one sampling location on the Willimantic River (Station 457), four stations on Eagleville Brook (Stations 1227, 1226, 1225, and 1697), and one station on Cedar Swamp Brook (Station 1659).

Water quality criteria for *E. coli*, along with bacteria sampling results from 2010, for the Willimantic River (CT3100-00_06) are presented in Table 10. Single sample values at Station 457 exceeded the WQS for *E. coli* 18 out of the 23 (78%) samples taken in 2010. The annual geometric mean was calculated for Station 457 and exceeded the WQS for *E. coli* in 2010.

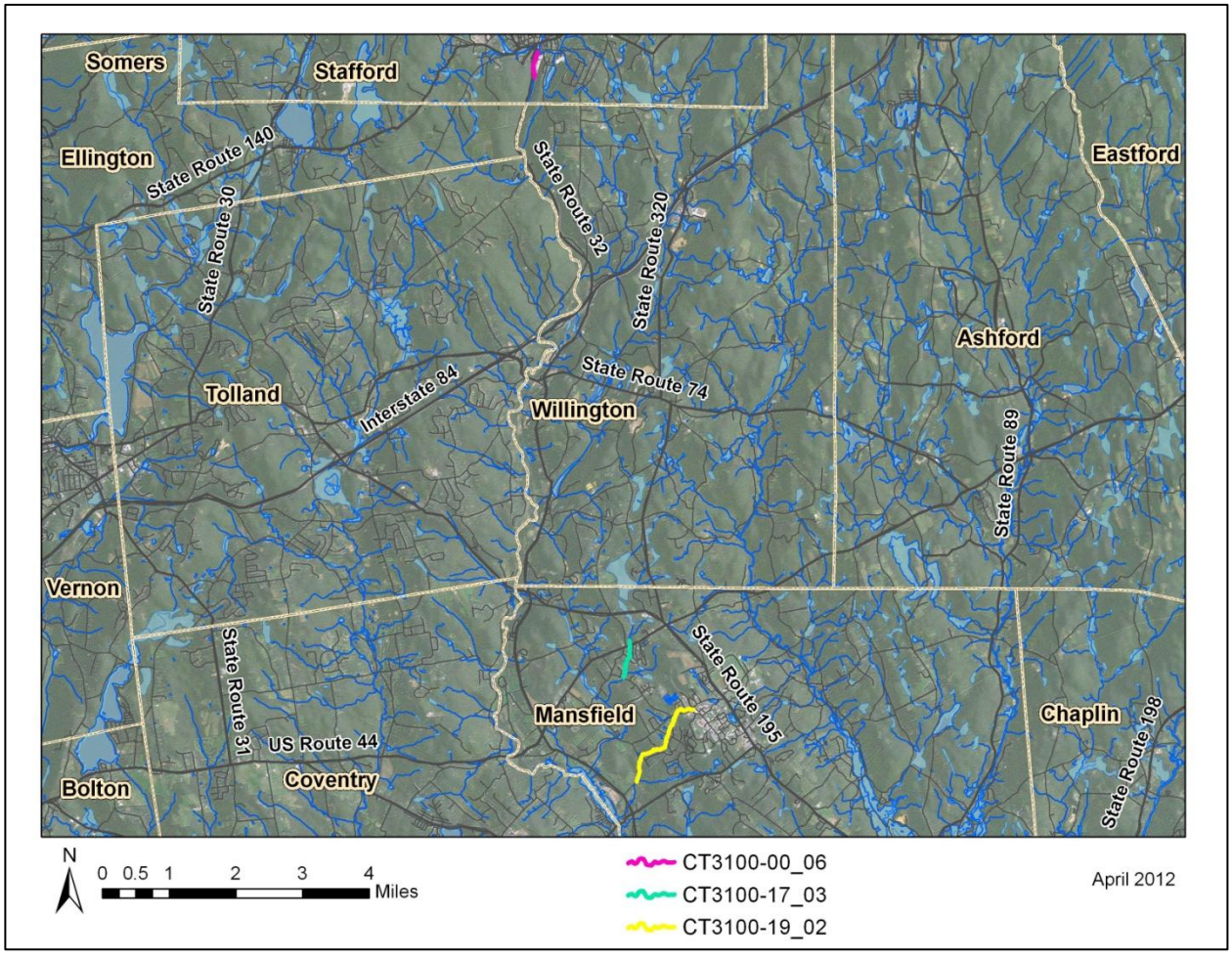
Water quality criteria for *E. coli*, along with bacteria sampling results from 2005 and 2010, for Eagleville Brook are presented in Table 11. Single sample values exceeded the WQS for *E. coli* multiple times at Stations 1227 and 1225 in 2005 and at Station 1697 in 2010. Single sample values exceeded the WQS for *E. coli* at Station 1226 at least once in 2005 and 2010. The annual geometric mean was calculated for all stations and exceeded the WQS for *E. coli* at Stations 1227, 1226, and 1225 in 2005.

Water quality criteria for *E. coli*, along with bacteria sampling results from 2010, for Cedar Swamp Brook are presented in Table 12. Single sample values at Station 1659 exceeded the WQS for *E. coli* multiple times in 2010. The annual geometric mean was calculated for Station 1659 and exceeded the WQS for *E. coli* in 2010.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for each station for wet-weather and dry-weather sampling days (Tables 10, 11, and 12). For the Willimantic River, the geometric mean at Station 457 exceeded the WQS for *E. coli* during both wet and dry-weather, and dry-weather was more than twice the wet-weather value. For Eagleville Brook, geometric means at Stations 1227, 1226, and 1225 exceeded the WQS for *E. coli* during wet-weather, and the geometric mean at Station 1226 also exceeded the WQS for *E. coli* during dry-weather. The geometric mean during wet-weather at Station 1226 was more than 10 times greater than the geometric mean during dry-weather, which may indicate a significant stormwater runoff issue. For Cedar Swamp Brook, the geometric mean at Station 1659 exceeded the WQS for *E. coli* during wet-weather, and wet-weather was nearly three times greater than the geometric mean during dry-weather.

Due to the elevated bacteria measurements presented in Tables 10, 11, and 12, the impaired segments of the Willimantic River, Eagleville Brook, and Cedar Swamp Brook did not meet CT's bacteria WQS, were identified as impaired, and were placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with State WQS.

Figure 7: Aerial map of the impaired segments in the Willimantic River watershed



POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the Willimantic River watershed based on land use (Figures 5 and 6) and a collection of local information for the impaired waterbodies are presented in Table 3 and Figures 8 and 9. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segment. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not suggest that there are no potential issues on these segments, but indicates a lack of current data to evaluate the segments as part of the assessment process. For some segments, there are data from permitted sources, and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Table 3: Potential bacteria sources in the Willimantic River watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/ Pets	Other
Willimantic River CT3100-00-06_01	**x**	**x**		**x**		**x**	**x**	
Eagleville Brook CT3100-19_02	**x**	**x**		**x**	**x**	**x**	**x**	**x**
Cedar Swamp Brook CT3100-17_03	**x**			**x**		**x**	**x**	

Figure 8: Potential sources in the Willimantic River watershed at the sub-regional level showing the Willimantic River impaired segment

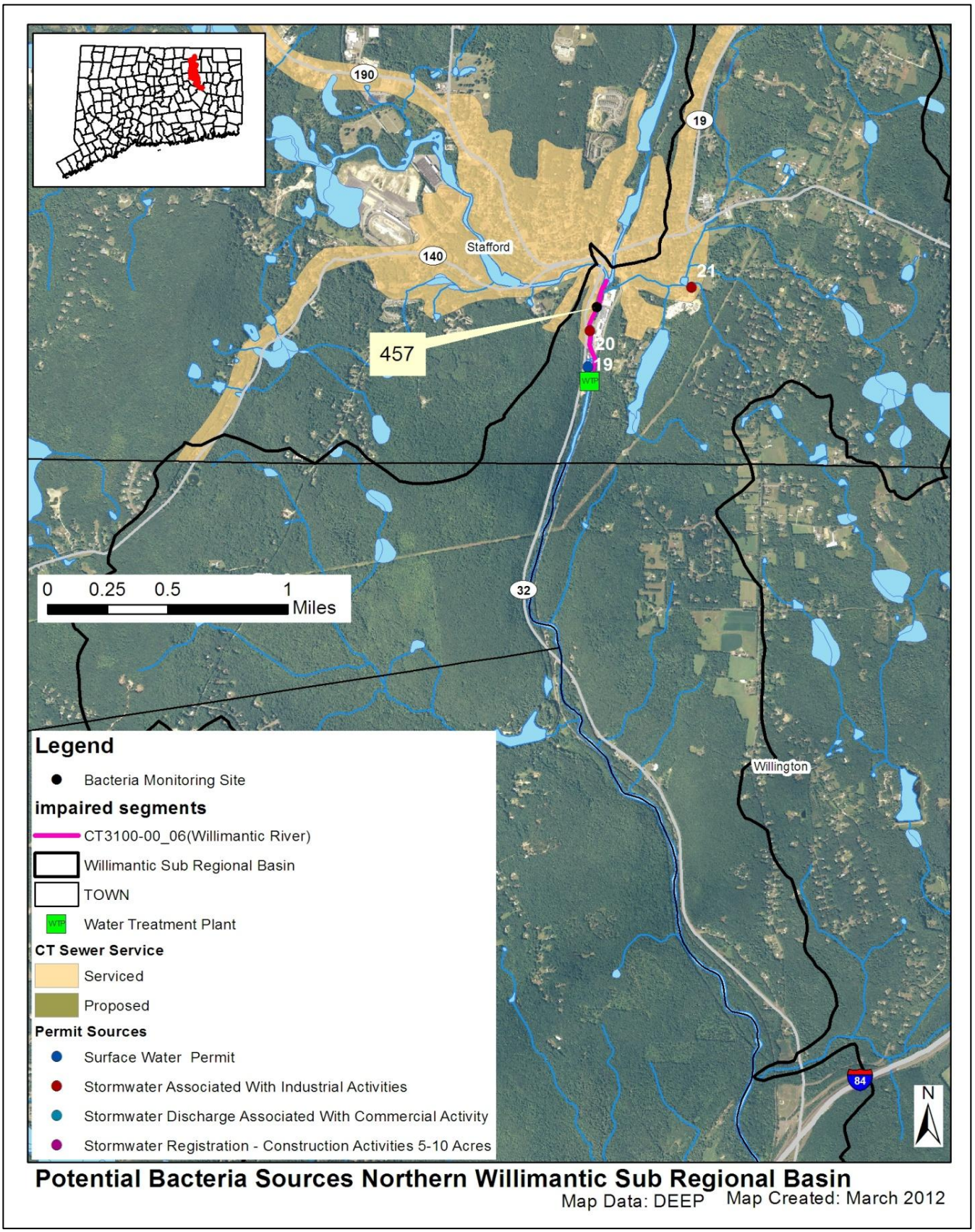
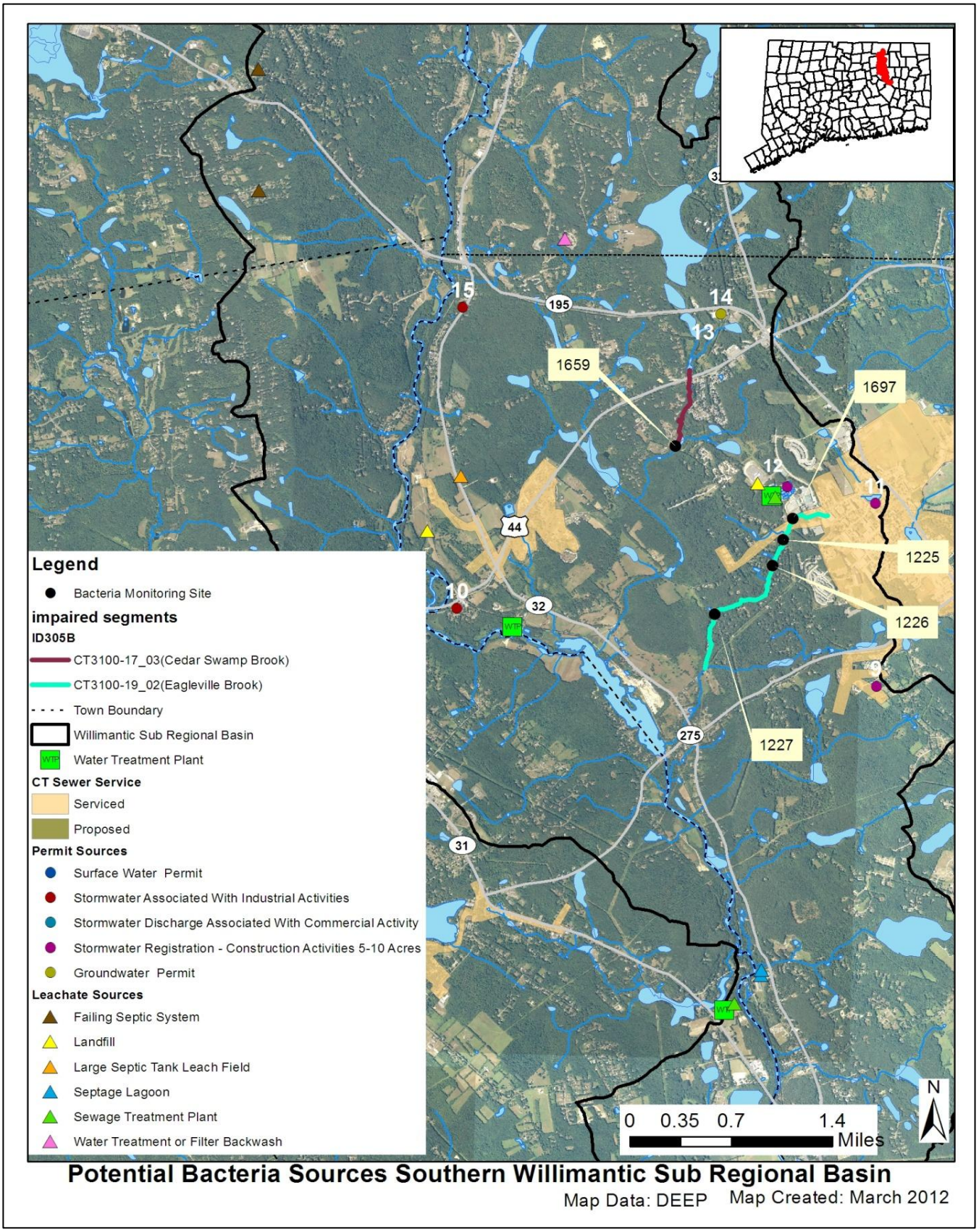


Figure 9: Potential sources in the Willimantic River watershed at the sub-regional level showing Eagleville Brook and Cedar Swamp Brook impaired segments



The potential sources map for the impaired basin was developed after thorough analysis of available data sets. If information is not displayed in the map, then no sources were discovered during the analysis. The following is the list of potential sources that were evaluated: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits, and construction related stormwater), and leachate and discharge sources (agricultural waste, CSOs, failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

Point Sources

Permitted sources within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. A list of active permits in the watershed is included in Table 5. Additional investigation and monitoring could reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type. When available, bacteria data results from these permitted sources are listed in Table 6.

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	1
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	0
GSI	Stormwater Associated with Industrial Activity	4
GSM	Part B Municipal Stormwater MS4	0
GSN	Stormwater Registration – Construction	3
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	2

Permitted Sources

As shown in Table 5, there are multiple permitted discharges in the Willimantic River watershed. Bacteria data from 2001 – 2005 from several of these industrial permitted facilities are included in Table 6. Although this data cannot be compared to a water quality standard as there is no recreation standard for fecal coliform, multiple samples were high with readings exceeding 1,000 colonies/100 mL, including Warren Corp (GSI000985), CUNO Inc. (GSI000253), and J.J. Motts Concrete (GSI001187). These results indicate that permitted discharges within the Willimantic River watershed may be contributing bacteria to the impaired segments. Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4

permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities within the Willimantic River watershed

Town	Client	Permit ID	Permit Type	Site Name	Address	Map #
Mansfield	CT DOT	GSI001176	Stormwater Associated With Industrial Activities	Mansfield Salt Storage	Plains Road	10
Mansfield	Board of Trustees Connecticut State University System	GSN001873	Stormwater Registration - Construction Activities 5-10 Acres	E.C.S.U. Women's NCAA Softball Field & Facilities	Mansfield City Road	9
Mansfield	University Of Connecticut	GSN002185	Stormwater Registration - Construction Activities 5-10 Acres	Reclaimed Water Facility	Ledoyt Road, UCONN	12
Mansfield	Rosal Trust	UI0000019	Groundwater Permit	Dundee's & Two Steps	Unknown	13
Stafford Springs	Town of Stafford	CT0101214	Surface Water Permit	Stafford WPCF	50 River Road	19
Stafford Springs	The Joseph J. Mottes Co.	GSI001187	Stormwater Associated With Industrial Activities	J.J. Motts Concrete Co.	10 Meadow Lane	21
Stafford Springs	3M Purification, Inc.	GSI001961	Stormwater Associated With Industrial Activities	3M Purification, Inc.	32 River Road	20
Storrs	University Of Connecticut	GSN002186	Stormwater Registration - Construction Activities 5-10 Acres	Storrs Hall Addition, UCONN	231 Glenbrook Road	11
Storrs Mansfield	Durham School Services	GSI002280	Stormwater Associated With Industrial Activities	Durham School Services	1725 Stafford Road	15
Storrs Mansfield	Rosal Trust	UI0000019	Groundwater Permit	Dundee's & Two Steps	1717 Storrs Road	14

Table 6: Industrial permits in the Willimantic River watershed and available fecal coliform data (colonies/100 mL). The result cannot be compared to the water quality standard as there is no recreation standard for fecal coliform.

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Stafford	CUNO, Inc.	GSI000253	Willimantic River	001	09/21/01	880
Stafford	CUNO, Inc.	GSI000253	Willimantic River	001	08/02/02	24
Stafford	CUNO, Inc.	GSI000253	Willimantic River	002	09/21/01	1,500

Table 6: Industrial permits in the Willimantic River watershed and available fecal coliform data (colonies/100 mL). The result cannot be compared to the water quality standard as there is no recreation standard for fecal coliform. (continued)

Town	Location	Permit Number	Receiving Water	Sample Location	Sample Date	Result
Stafford	CUNO, Inc.	GSI000253	Willimantic River	003	09/21/01	6,300
Stafford	CUNO, Inc.	GSI000253	Willimantic River	004	09/21/01	3,400
Stafford	Warren Corp.	GSI000985	Willimantic River	001	09/26/02	1,400
Stafford	Warren Corp.	GSI000985	Willimantic River	001	06/18/03	2,200
Stafford	Warren Corp.	GSI000985	Willimantic River	002	09/26/02	250
Stafford	Warren Corp.	GSI000985	Willimantic River	002	06/18/03	150
Stafford	Stafford Enterprises	GSI001343	Tributary to Willimantic River	001	03/26/02	2
Stafford	Stafford Enterprises	GSI001343	Tributary to Willimantic River	001	08/29/02	>600
Stafford	Stafford Enterprises	GSI001343	Tributary to Willimantic River	003	03/26/02	18
Stafford	Stafford Enterprises	GSI001343	Tributary to Willimantic River	003	08/29/02	>600
Stafford Springs	J.J. Motts Concrete Co.	GSI001187	Dennis Pond	001	07/17/01	10
Stafford Springs	J.J. Motts Concrete Co.	GSI001187	Dennis Pond	001	09/26/02	10
Stafford Springs	J.J. Motts Concrete Co.	GSI001187	Dennis Pond	001	06/18/03	80
Stafford Springs	J.J. Motts Concrete Co.	GSI001187	Dennis Pond	drain to stream	10/22/05	3,300

Municipal Stormwater Permitted Sources

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663)

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a

UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA. (67 FR 11663)

While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an MS4 permit. This oversight can explain a municipality that is at least partially shaded grey in the maps and there are no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program. One reason a waiver could be granted is a municipality with a total population less than 1000 people, even if the municipality was located in a UA. There are 19 municipalities in Connecticut that have received waivers, this list is: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Cromwell. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

The impaired segments of the Willimantic River watershed are in the Towns of Stafford and Mansfield. As mentioned above, Mansfield (Storrs) is an Urban Cluster (UC) block and Stafford is one of 19 municipalities in Connecticut to receive a waiver, and therefore, these towns are not designated urban areas and are not required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the CT DEEP (Figures 10 and 11). Information regarding stormwater management and the MS4 permit can be obtained on CT DEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Figure 10: MS4 areas of the Willimantic River watershed – Showing the Willimantic River impaired segment

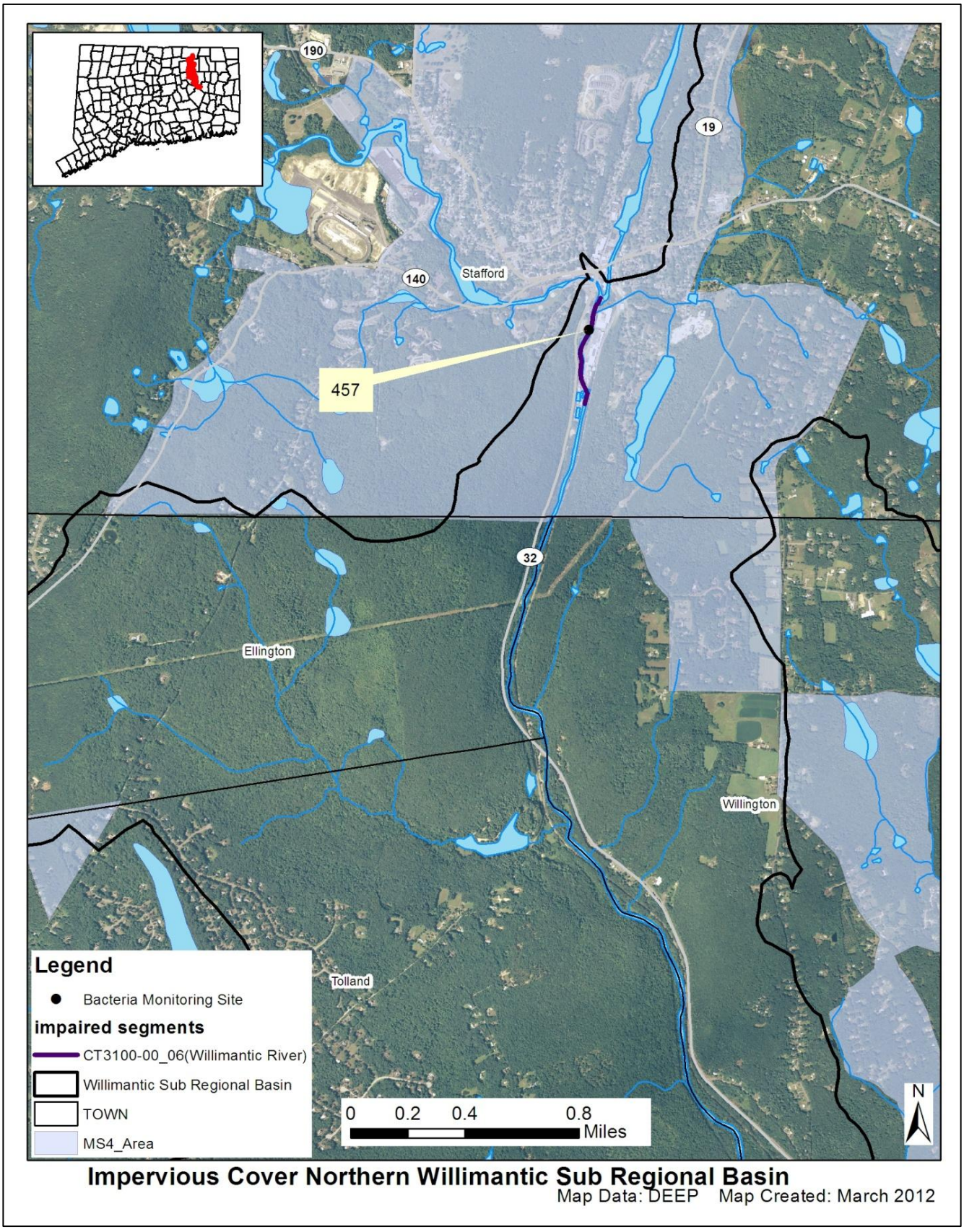
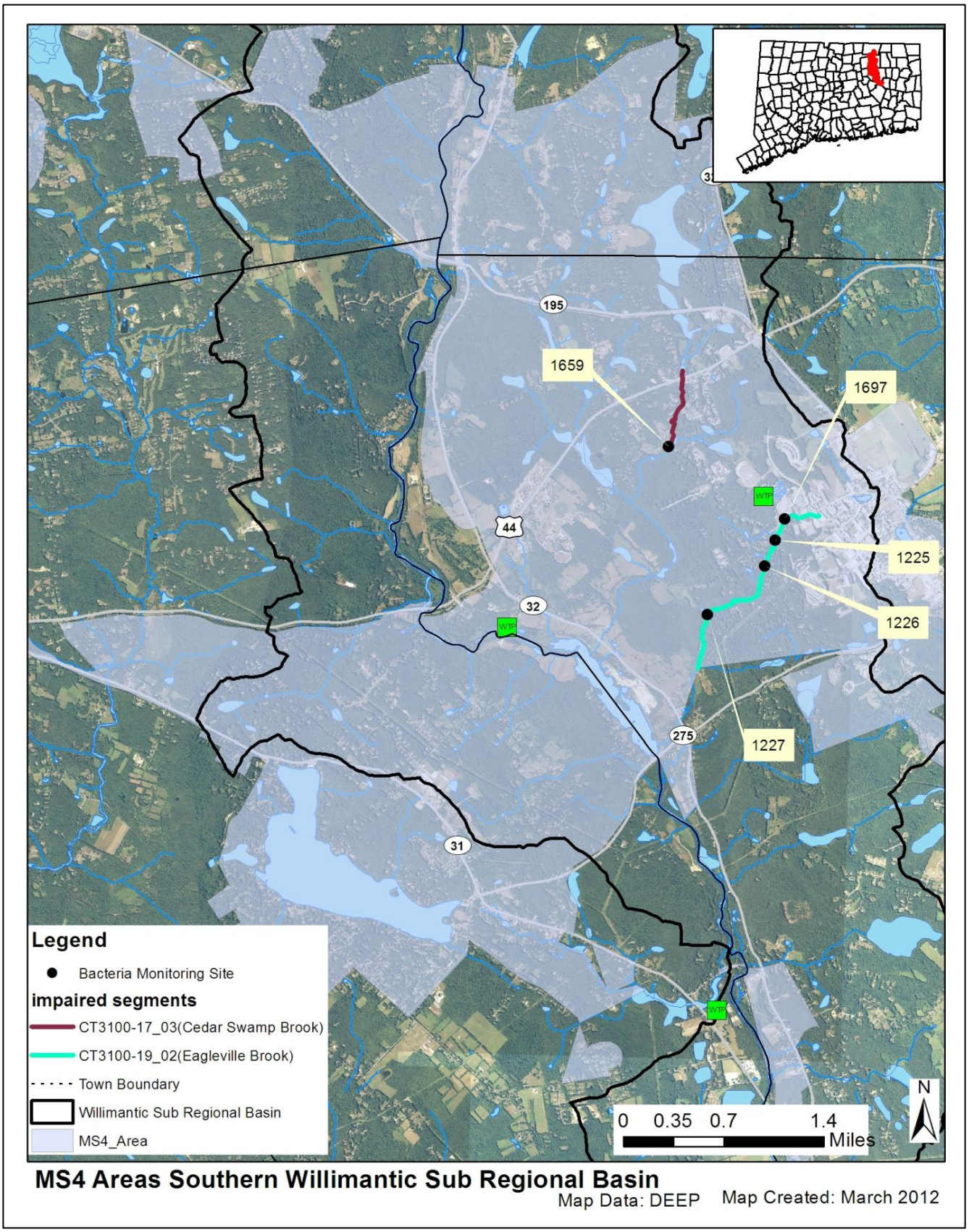


Figure 11: MS4 areas of the Willimantic River watershed – Showing Eagleville Brook and Cedar Swamp Brook impaired segments



Publicly Owned Treatment Works

As shown in Figures 8 and 9, there are four publicly owned treatment works (POTWs), or wastewater treatment plants, in the Willimantic River watershed, one of which is in Stafford at the downstream terminus of the Willimantic River (CT3100-00_06), two of which are located along the Willimantic River in Mansfield, and one of which is located along Eagleville Brook in Mansfield. Data were only available for the Stafford Water Pollution Control Facility (WPCF) (CT0101214) along the Willimantic River (CT3100-00_06), which exceeded its 7-day and 30-day geometric mean permit limit on at least one sampling date in 2010 (Table 7).

Table 7: Wastewater treatment plant fecal coliform (colonies/100 mL) data discharging to the Willimantic River

Town	Permitee	Permit Number	Receiving Water	Date	30-Day Geometric Mean	7-Day Geometric Mean
Stafford	Stafford WPCF	CT0101214	Willimantic River	05/31/2009	16	23
Stafford	Stafford WPCF	CT0101214	Willimantic River	06/30/2009	11	15
Stafford	Stafford WPCF	CT0101214	Willimantic River	07/31/2009	6	9
Stafford	Stafford WPCF	CT0101214	Willimantic River	08/31/2009	9	16
Stafford	Stafford WPCF	CT0101214	Willimantic River	09/30/2009	5	14
Stafford	Stafford WPCF	CT0101214	Willimantic River	05/31/2010	45	134
Stafford	Stafford WPCF	CT0101214	Willimantic River	06/30/2010	9	69
Stafford	Stafford WPCF	CT0101214	Willimantic River	07/31/2010	16	169
Stafford	Stafford WPCF	CT0101214	Willimantic River	08/31/2010	207	770
Stafford	Stafford WPCF	CT0101214	Willimantic River	09/30/2010	146	1999
Stafford	Stafford WPCF	CT0101214	Willimantic River	05/31/2011	3	14
Stafford	Stafford WPCF	CT0101214	Willimantic River	07/31/2011	1	10
Stafford	Stafford WPCF	CT0101214	Willimantic River	08/31/2011	1	5
30-Day Geometric Mean Permit Limit = 200 colonies/100 mL						
7-Day Geometric Mean Permit Limit = 400 colonies/100 mL						

Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land-use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture, and contact recreation (swimming or wading). Potential sources of NPS within the Willimantic River watershed are described below.

Stormwater Runoff from Developed Areas

Approximately 24% of the watershed is considered urban, the majority of which is concentrated around the impaired segments in the Towns of Mansfield and Stafford (Figures 5 and 6). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate the soil. Studies have shown a link between increasing impervious cover and degrading water quality conditions in a watershed (CWP, 2003). In one study, researchers

correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin *et al*., 2000).

Approximately 86% of the Willimantic River watershed is characterized by 0-6% impervious cover, 5% is characterized by 7-11% impervious cover, 3% is characterized by 12-15% impervious cover, particularly along the majority of Eagleville Brook, and 6% is characterized by greater than 16% impervious cover, particularly in the upstream reaches of the Willimantic River (CT3100-00_06) (Figures 12, 13, and 14). The western portion of the University of Connecticut's main campus in Mansfield (Storrs) drains into Eagleville Brook, and contains large sections of impervious surface such as buildings, roads, walkways, and parking lots. Water quality data taken at Station 457 on the Willimantic River, Stations 1227, 1226, and 1225 on Eagleville Brook, and Station 1659 on Cedar Swamp Brook were consistently high, especially during wet-weather, which suggests that stormwater runoff may be a source of bacteria to the Willimantic River watershed (Tables 10, 11,and 12). In particular, geometric means during wet-weather at Stations 1226 and 1659 were 10 and 3 times greater than dry-weather values, respectively.

Figure 12: Range of impervious cover (%) in the Willimantic River watershed

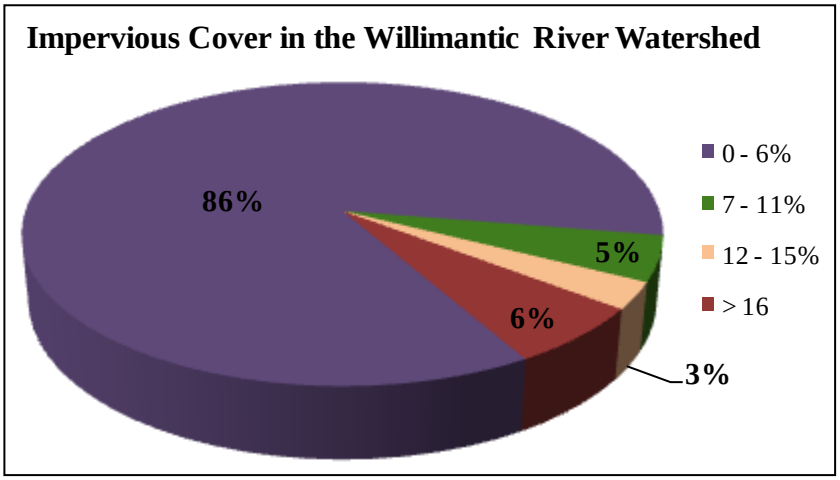


Figure 13: Impervious cover (%) for the Willimantic River sub-regional watershed showing the Willimantic River impaired segment

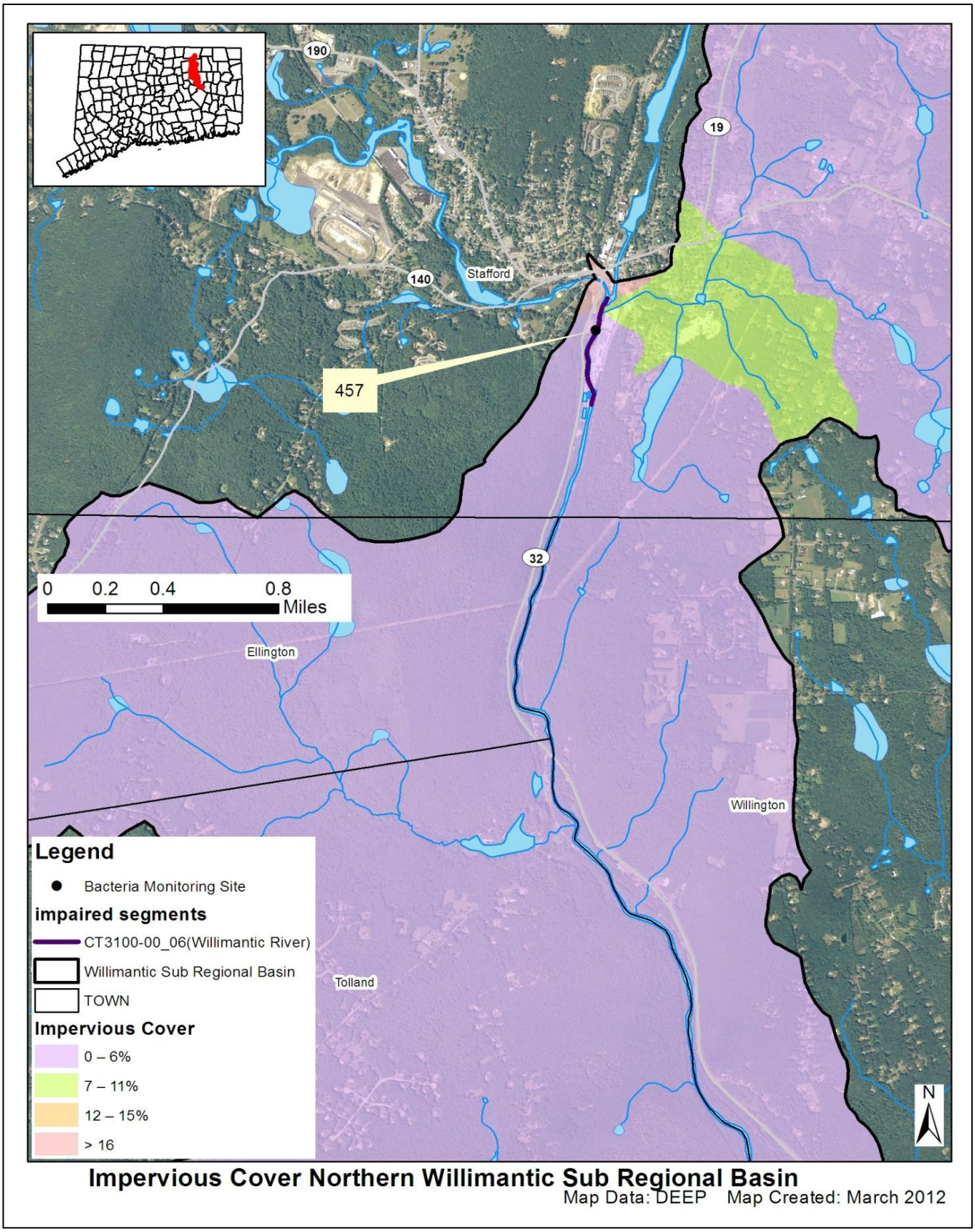
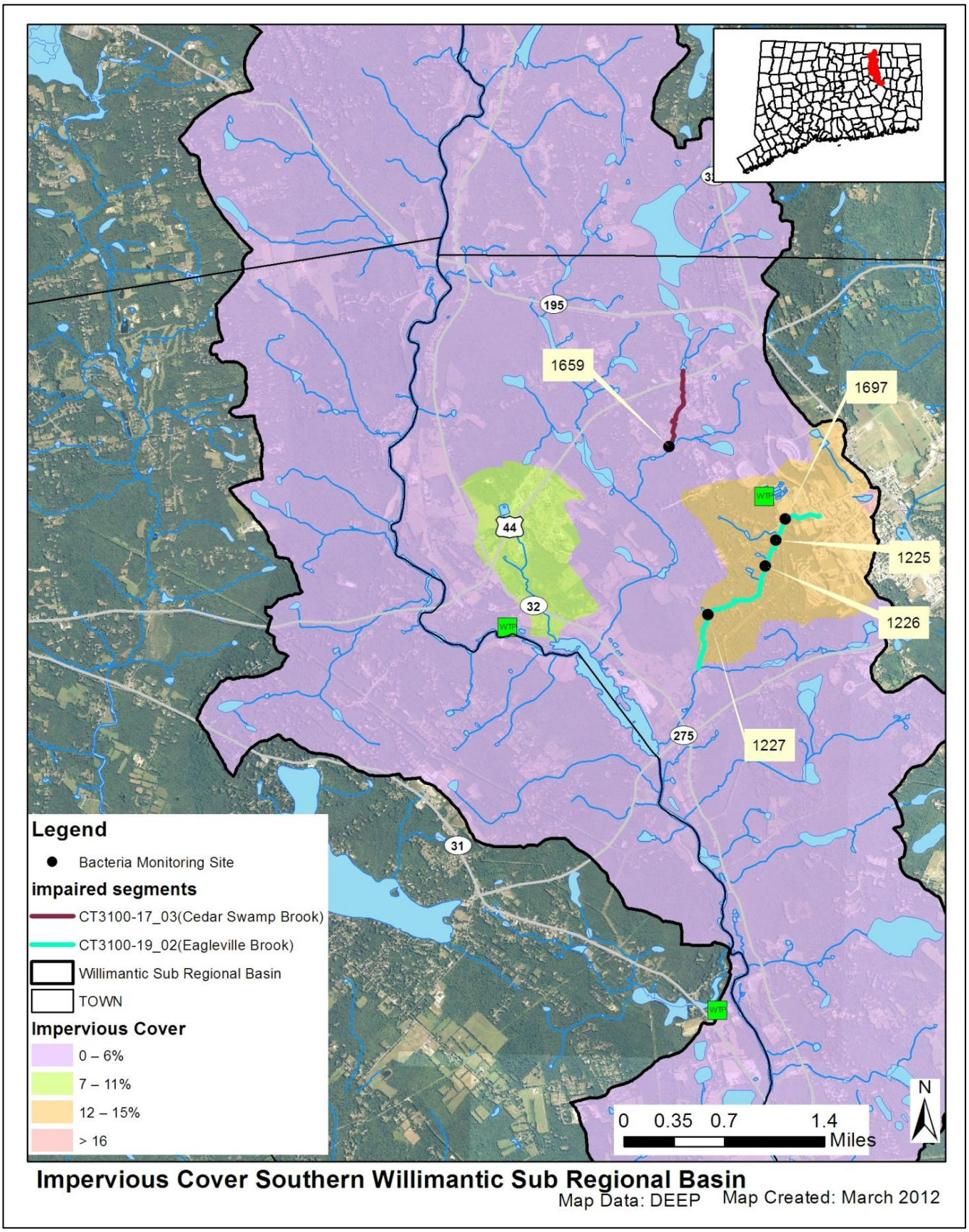


Figure 14: Impervious cover (%) for the Willimantic River sub-regional watershed showing the Eagleville Brook and Cedar Swamp Brook impaired segments



Insufficient Septic Systems and Illicit Discharges

As shown in Figures 8 and 9, there are residential and commercial areas around the impaired segments that do not have access to a sanitary sewer and instead rely on onsite wastewater treatments systems, such as septic systems. Two failing septic systems were identified in Figures 8 and 9 along tributaries to the Willimantic River north of Cedar Swamp Brook and Eagleville Brook. Although not directly impacting the impaired segments, these failing septic systems may be an indication of a more widespread issue in the watershed. A large septic tank leachfield was also identified along Route 32 and the Willimantic River upstream of the confluences with Cedar Swamp Brook and Eagleville Brook. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters. In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. The Town of Stafford has its own Health Department (www.staffordct.org/health.php). The Town of Mansfield is part of the greater Eastern Highlands Health District (www.ehhd.org).

There are multiple areas within the watershed with access to a sanitary sewer, including the majority of the Willimantic River (CT3100-00_06) in Stafford and the upstream portion of Eagleville Brook in Mansfield (Figures 8 and 9). Sewer system leaks and other illicit discharges located within the watershed, particularly near the impaired segments of the Willimantic River and Eagleville Brook, may be contributing bacteria to these waterbodies. Water quality data taken at Station 457 on the Willimantic River, and Station 1226 on Eagleville Brook were consistently high, especially during dry-weather, which suggests that leaks from septic systems or sewer pipes may be a source of bacteria to the Willimantic River watershed (Tables 10,11, and 12). In particular, geometric means during dry-weather values at Station 457 were twice that of wet-weather values.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Willimantic River watershed represent a potential source of bacteria. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. These physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001).

Geese and other waterfowl are known to congregate in open areas, including recreational fields, golf courses, and agricultural crop fields. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants.

As hotspots for dog and horse owners, residential development surrounds portions of all three impaired segments in the Willimantic River watershed, particularly along Hyde Park Road and Highland Terrace in Stafford adjacent to the Willimantic River (CT3100-00_06), along Hunting Lodge Road and Separatist Road near Eagleville Brook in Mansfield, and along Old Wood Road adjacent to Cedar Swamp Brook in Mansfield. When not properly disposed, waste from domestic animals such as dogs and horses can enter surface waters directly or through stormwater infrastructure.

Agricultural Activities

Agricultural operations are an important economic activity and landscape feature in many areas of the State. Runoff from agricultural fields may contain pollutants such as bacteria and nutrients (USEPA, 2011a). This runoff can include pollutants from farm practices such as storing manure, allowing livestock

to wade in nearby waterbodies, applying fertilizer, and reducing the width of vegetated buffer along the shoreline. Agricultural land use makes up 8% of the Willimantic River watershed (Figure 4). There are few agricultural operations near the impaired segments. Of particular note, agricultural areas were identified near the downstream terminus of Eagleville Brook off North Eagleville Road. These operations may carry pollutants, including bacteria, to the impaired segments.

Additional Sources

Two landfills were identified in the Willimantic River watershed in Mansfield (Figure 9). One is located near the Willimantic River upstream of the confluences with Cedar Swamp Brook and Eagleville Brook. The other is located near the upstream portion of Eagleville Brook and may be a concern for water quality. There may be other sources not listed here or identified in Figures 8 and 9 that contribute to the observed water quality impairment in the Willimantic River, Eagleville Brook, and Cedar Swamp Brook. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

Land Use/Landscape

Riparian Buffer Zones

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has created streamside buffer layers for the entire State of Connecticut (http://clear.uconn.edu/), which have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff sources.

The riparian zones of the entire Willimantic River (CT3100-00_06) and the upstream reaches of Eagleville Brook are characterized by developed land use (Figures 15 and 16). The riparian zone along downstream portion of Eagleville Brook is primarily forested. The riparian zone of Cedar Swamp Brook is characterized by a mix of forested, developed, and turf/grass areas. Developed areas within the riparian zone likely contribute pollutants such as bacteria to the waterbody since the natural riparian buffer cannot treat stormwater runoff from impervious surfaces.

Figure 15: Riparian buffer zone information for the Willimantic River watershed showing the Willimantic River impaired segment

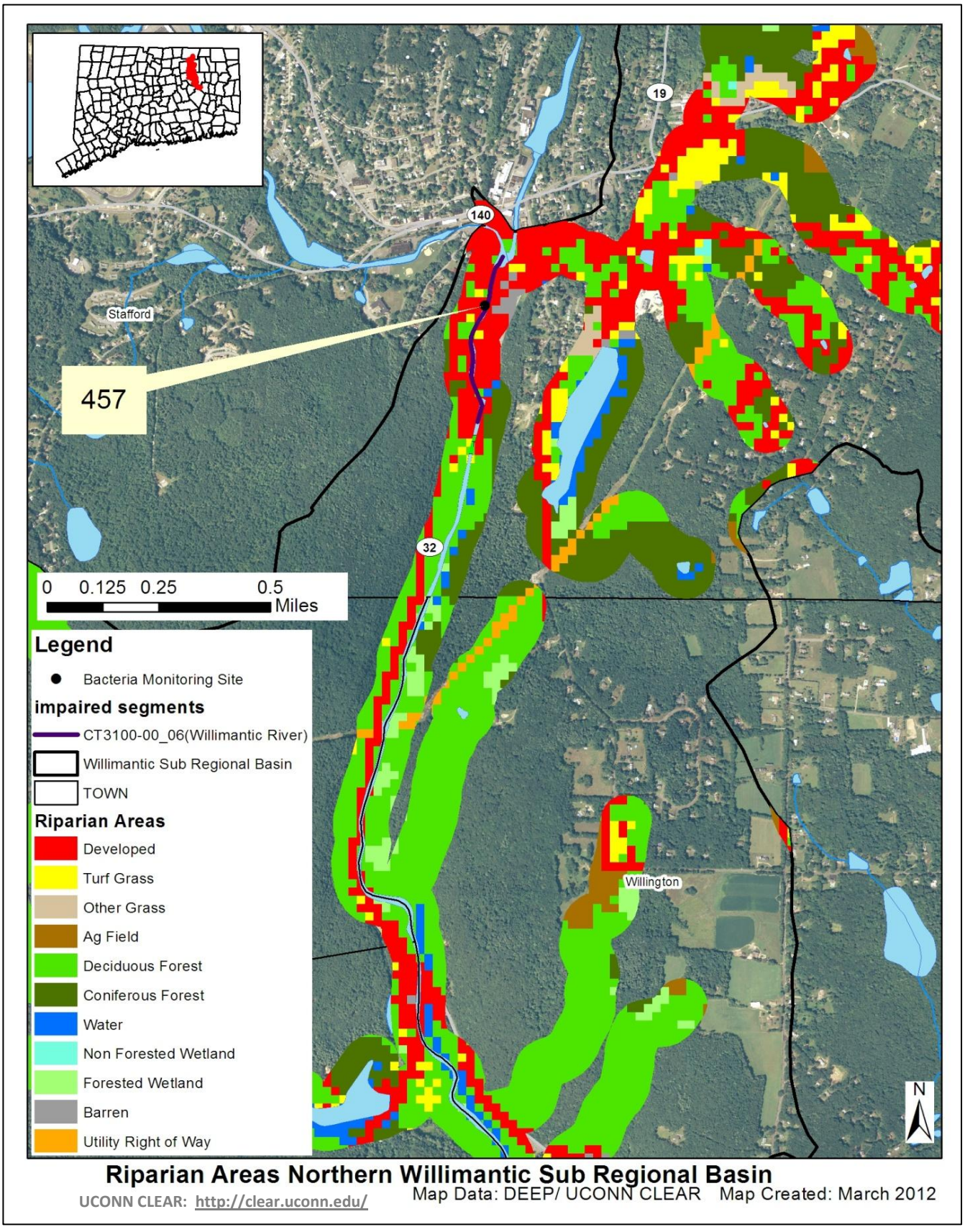
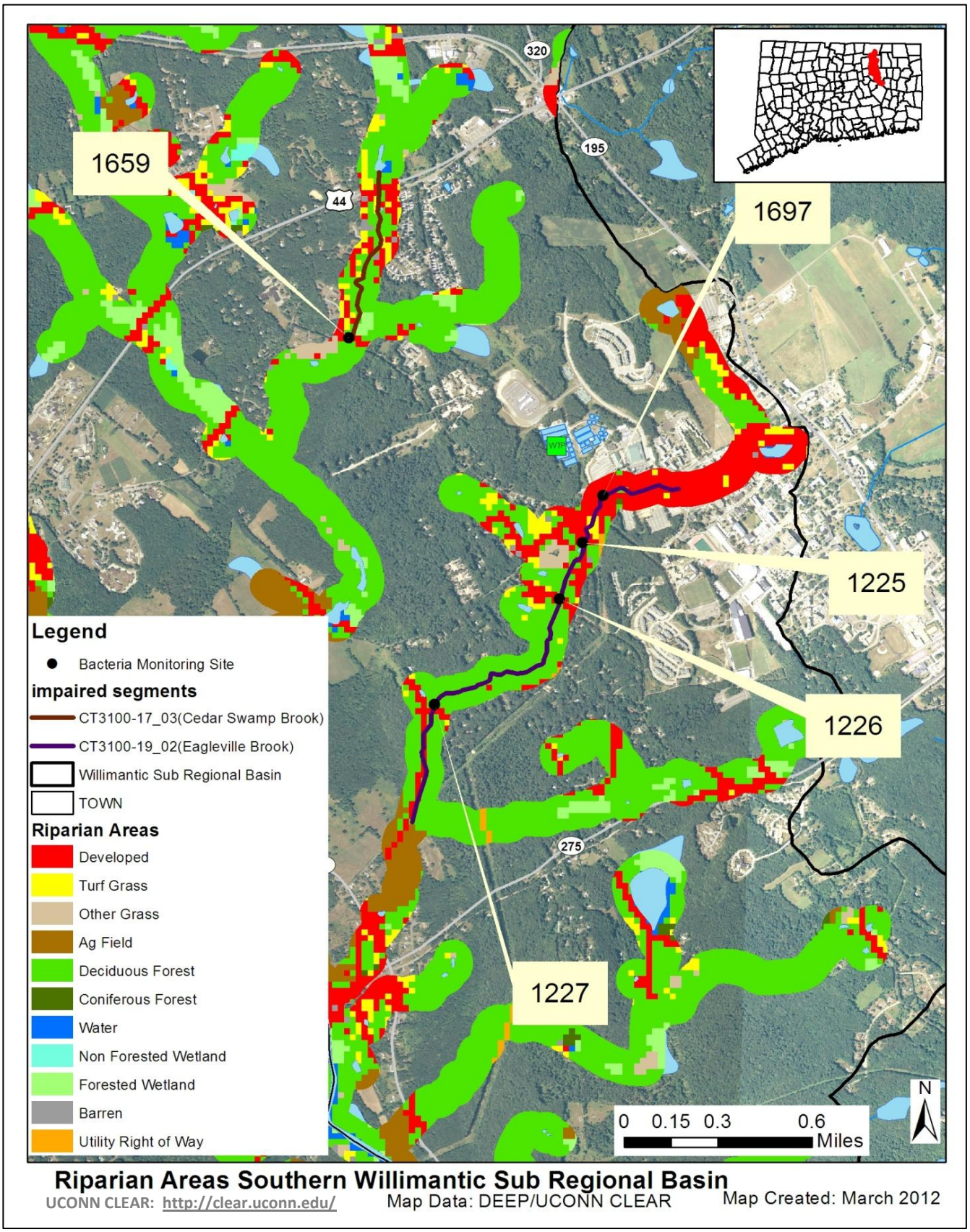


Figure 16: Riparian buffer zone information for the Willimantic River watershed showing the Eagleville Brook and Cedar Swamp Brook impaired segments



CURRENT MANAGEMENT ACTIVITIES

The watershed community has developed and implemented programs to protect water quality from bacterial contamination. In 2011, the Eagleville Brook Watershed Management Plan was developed by the University of Connecticut Cooperative Extension and made available at http://www.ct.gov/dep/lib/dep/water/watershed_management/wm_plans/eagleville_brook_wbplan.pdf. This document outlines current actions in the watershed in response to the 2007 Eagleville Brook Impervious Cover (IC) TMDL and recommends future actions necessary to maintain or improve water quality (Dietz and Arnold, 2011).

CT DEEP's Non-Point Source Pollution Program administers a Non-Point Source Grant Program with funding from EPA under Section 319 of the Clean Water Act (319 grant). A $200,000 319 grant was awarded to the University of Connecticut (UConn) to support the completion of an impervious cover-based TMDL for Eagleville Brook and ultimately address TMDL goals through a watershed-based management plan. In response to the Eagleville Brook IC TMDL, a $50,000 319 grant was awarded to the UConn to install and monitor a green roof on Gant Plaza on the UConn campus and determine other suitable locations for disconnection of impervious areas through bioretention installation.

RECOMMENDED NEXT STEPS

The Town of Mansfield has developed and implemented programs to protect water quality from bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of the Willimantic River watershed and have been prioritized below. Some of these actions are provided in more detail in the 2011 Eagleville Brook Watershed Based Plan (Dietz and Arnold, 2011).

Table 8: Recommended structural BMPs in Mansfield from the 2011 Eagleville Brook Watershed Based Plan

Location	Town	Recommended BMPs
UConn - Warehouse and Motor Pool	Mansfield	Install perimeter sand filter and green roof
UConn - F Lot	Mansfield	Install terraced bioretention areas.
UConn - Hurley Hall	Mansfield	Install rooftop and walkway bioretention areas.
UConn - Chemistry Building Quad	Mansfield	Install rooftop and walkway bioretention areas.
UConn - North Eagleville Road	Mansfield	Integrate stormwater, landscaping, and traffic calming measures by installing street planter areas.
UConn - Lot 9	Mansfield	Install parking lot bioretention areas (grassed swales).
UConn - Lot Y	Mansfield	Manage parking lot with bioswales.
UConn - Christian Field/Batting Cages	Mansfield	Install gravel-based wetland system.
UConn - Lot W	Mansfield	Manage parking lot with bioretention areas.
UConn - Education/Gentry Buildings and Sundial Garden	Mansfield	Integrate stormwater and landscape management by installing planter beds and buffers.

1) Identify areas in the developed portions of the Willimantic River watershed to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, 24% of the Willimantic River watershed is considered urban. As such, stormwater runoff is likely contributing bacteria to the impaired segments of the Willimantic River watershed. To mitigate stormwater runoff to Eagleville Brook, the University of Connecticut (UConn) has already installed multiple BMPs throughout the campus. Bioretention areas were constructed at the Towers dorm in 2004, at the Burton-Skenkman Facility and Hilltop dorms in 2005, and at the Northwoods apartments and complex in 2010. Pervious pavement (either porous asphalt or pervious concrete) were installed at Lakeside apartments in 2005, at the Towers dorms and field house in 2009, and along a portion of the access road to Northwoods apartments in 2010. As noted previously, a green roof was installed on Gant Plaza in 2009 using funding from a 319 grant. The Eagleville Brook Watershed Management Plan made several recommendations for BMP installations that would disconnect impervious areas discharging directly to Eagleville Brook, including 110 potential projects at 51 sites on the UConn campus. Recommended BMPs at parking lots, academic buildings, and student housing include rain gardens,

grassed swales, water harvesting stations, pervious pavement, and green roofs. A sampling of high priority BMP sites addressed in the plan is listed in Table 8.

To identify other areas that are contributing bacteria to the impaired segments, the towns should continue to conduct wet-weather sampling and prioritize sampling stations with high bacteria concentrations for BMP installation (Table 6). To treat stormwater runoff, the towns should identify areas along the impaired segments to install BMPs that encourage stormwater to infiltrate the ground before entering the waterbodies. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. More detailed information and BMP recommendations can be found in the core TMDL document.

2) Continue monitoring of permitted sources.

As shown in Figures 8 and 9, there are multiple permitted discharges within the Willimantic River watershed near the impaired segments. Further monitoring will provide information essential to better locate, understand, and reduce pollution sources. If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of the permit required, and voluntary measures to identify and reduce sources of bacterial contamination at the facility are an additional recommendation. Regular monitoring should be established for all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within four months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established by the TMDL. For discharges to impaired waterbodies, the municipality must assess and modify the six minimum measures of its plan, if necessary, to meet TMDL standards. Particular focus should be placed on the following plan components: public education, illicit discharge detection and elimination, stormwater structures cleaning, and the repair, upgrade, or retrofit of storm sewer structures. The goal of these modifications is to establish a program that improves water quality consistent with TMDL requirements. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval.

Table 9 details the appropriate bacteria criteria for use as waste load allocations established by this TMDL for use as water quality targets by permittees as permits are renewed and updated, within the Willimantic River Watershed.

For any municipality subject to an MS4 permit and affected by a TMDL, the permit requires a modification of the SMP to include BMPs that address the included impairment. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways.

Any facilities that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall

stormwater volumes. Facilities that are regulated under the Commercial Activities Stormwater Permit should report any updates to their SMP in their summary documentation submitted to DEEP.

Table 9. Bacteria (e.coli) TMDLs, WLAs, and LAs for Recreational Use

		Instantaneous *E. coli* (#/100mL)						Geometric Mean *E. coli* (#/100mL)	
Class	**Bacteria Source**	**WLA[6]**			**LA[6]**			**WLA[6]**	**LA[6]**
	Recreational Use	[1]	[2]	[3]	[1]	[2]	[3]	**All**	**All**
A	Non-Stormwater NPDES	0	0	0				0	
	CSOs	0	0	0				0	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126
B[4]	Non-Stormwater NPDES	235	410	576				126	
	CSOs	235	410	576				126	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126

(1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.

(2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

(3) **All Other Recreational Uses.**

(4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)

(5) Human direct discharge = swimmers

(6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(7) Replace numeric value with "natural levels" if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

3) Develop a system to monitor septic systems.

The majority of residents within the Willimantic River watershed, particularly near the impaired segments, rely on septic systems. If not already in place, the towns should establish a program to ensure that existing septic systems are properly operated and maintained. For instance, communities can create

an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of the sub-standard systems within a reasonable timeframe could be adopted. Towns can also develop programs to assist citizens with the replacement and repair of older and failing systems.

4) Implement a program to evaluate the sanitary sewer system.

Many residents and businesses surrounding the Willimantic River (CT3100-00_06) and the upstream portion of Eagleville Brook rely on a municipal sewer system (Figures 8 and 9). It is important for municipalities to develop a program to evaluate their sanitary sewer and reduce leaks and overflows. This program should include periodic inspections of the sewer line.

5) Evaluate municipal education and outreach programs regarding animal waste.

Any education and outreach programs should highlight the importance of not feeding waterfowl and wildlife, managing horse and livestock waste, and picking up after dogs and other pets. Municipalities and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of the Willimantic River and its tributaries that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Willimantic River watershed and can harm human health and the environment. Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-use areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas.

6) Ensure there are sufficient buffers and BMPs in place on agricultural lands along the impaired segments.

Agricultural land use represents 8% of the Willimantic River watershed, and may be a concern for water quality in the impaired segments, particularly agricultural operations near the downstream terminus of Eagleville Brook. If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict access to livestock and horses from streams and wetlands, and that animal waste handling, disposal, and other appropriate BMPs are in place.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 10: Willimantic River Bacteria Data

Waterbody ID: CT3100-00_06

Characteristics: Freshwater, Class B, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **84%**

Single Sample: **89%**

Data: 2010 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from Station 457 on the Willimantic River with annual geometric means calculated

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
457	Upstream Stafford POTW adjacent to park	4/27/2010	130	wet	**808* (84%)**
457	Upstream Stafford POTW adjacent to park	5/5/2010	310	dry	
457	Upstream Stafford POTW adjacent to park	5/11/2010	97	dry	
457	Upstream Stafford POTW adjacent to park	5/18/2010	150	wet	
457	Upstream Stafford POTW adjacent to park	5/25/2010	250	dry	
457	Upstream Stafford POTW adjacent to park	6/1/2010	490	wet	
457	Upstream Stafford POTW adjacent to park	6/8/2010	590	dry	
457	Upstream Stafford POTW adjacent to park	6/15/2010	530	dry	
457	Upstream Stafford POTW adjacent to park	6/22/2010	490	wet	
457	Upstream Stafford POTW adjacent to park	6/29/2010	740	dry	
457	Upstream Stafford POTW adjacent to park	7/6/2010	990	dry	
457	Upstream Stafford POTW adjacent to park	7/13/2010	1500	wet	
457	Upstream Stafford POTW adjacent to park	7/20/2010	**3900* (89%)**	dry	
457	Upstream Stafford POTW adjacent to park	7/27/2010	1100	dry	
457	Upstream Stafford POTW adjacent to park	8/3/2010	1800	dry	
457	Upstream Stafford POTW adjacent to park	8/10/2010	2000	dry	

457	Upstream Stafford POTW adjacent to park	8/17/2010	3300	dry	
457	Upstream Stafford POTW adjacent to park	8/24/2010	1300	dry	
457	Upstream Stafford POTW adjacent to park	8/31/2010	2000	dry	
457	Upstream Stafford POTW adjacent to park	9/7/2010	1700	dry	
457	Upstream Stafford POTW adjacent to park	9/14/2010	1900	dry	
457	Upstream Stafford POTW adjacent to park	9/21/2010	1800	dry	
457	Upstream Stafford POTW adjacent to park	9/28/2010	790	wet	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather geometric mean values for Station 457 on the Willimantic River

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
457	Upstream Stafford POTW adjacent to park	2010	6	17	808	421	1017

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gages at Hartford Bradley International Airport, CT.

Table 11: Eagleville Brook Bacteria Data

Waterbody ID: CT3100-19_02

Characteristics: Freshwater, Class A, Potential Drinking Water Source, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **91%**

Single Sample: **96%**

Data: 2005 and 2010 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on Eagleville Brook with annual geometric means calculated

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
1227	Upstream of Hillyndale Road	8/15/2005	2900	wet	701
1227	Upstream of Hillyndale Road	8/16/2005	440	wet	
1227	Upstream of Hillyndale Road	8/17/2005	270	dry	
1227	Upstream of Hillyndale Road	4/27/2010	190	wet	28
1227	Upstream of Hillyndale Road	5/5/2010	10	dry	
1227	Upstream of Hillyndale Road	5/11/2010	10	dry	
1227	Upstream of Hillyndale Road	5/18/2010	10	dry	
1227	Upstream of Hillyndale Road	5/25/2010	10	dry	
1227	Upstream of Hillyndale Road	6/1/2010	10	dry	
1227	Upstream of Hillyndale Road	6/8/2010	10	dry	
1227	Upstream of Hillyndale Road	6/15/2010	150	dry	
1227	Upstream of Hillyndale Road	6/22/2010	200	dry	
1227	Upstream of Hillyndale Road	6/29/2010	31	wet	
1227	Upstream of Hillyndale Road	7/6/2010	52	dry	

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on Eagleville Brook with annual geometric means calculated (continued)

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
1226	Upstream of Separatist Road	8/15/2005	1100	wet	**1351* (91%)**
1226	Upstream of Separatist Road	8/16/2005	440†	wet	
1226	Upstream of Separatist Road	8/17/2005	5100	dry	
1226	Upstream of Separatist Road	4/27/2010	510	wet	211
1226	Upstream of Separatist Road	5/5/2010	200	dry	
1226	Upstream of Separatist Road	5/11/2010	84	dry	
1226	Upstream of Separatist Road	5/18/2010	85	dry	
1226	Upstream of Separatist Road	5/25/2010	98	dry	
1226	Upstream of Separatist Road	6/1/2010	220	dry	
1226	Upstream of Separatist Road	6/8/2010	7700	dry	
1226	Upstream of Separatist Road	6/15/2010	140	dry	
1226	Upstream of Separatist Road	6/22/2010	310	dry	
1226	Upstream of Separatist Road	6/29/2010	400	wet	
1226	Upstream of Separatist Road	7/6/2010	210	dry	
1226	Upstream of Separatist Road	7/13/2010	260	dry	
1226	Upstream of Separatist Road	7/20/2010	190	wet	
1226	Upstream of Separatist Road	7/27/2010	160	dry	
1226	Upstream of Separatist Road	8/3/2010	220	Dry	
1226	Upstream of Separatist Road	8/10/2010	700	dry	
1226	Upstream of Separatist Road	8/17/2010	1600	wet	
1226	Upstream of Separatist Road	8/24/2010	440	wet	
1226	Upstream of Separatist Road	8/31/2010	160	Dry	
1226	Upstream of Separatist Road	9/7/2010	160	dry	
1226	Upstream of Separatist Road	9/14/2010	41	Dry	
1226	Upstream of Separatist Road	9/21/2010	74	dry	
1226	Upstream of Separatist Road	9/28/2010	10	wet	
1225	#43 Hunting Lodge Road (private driveway)	8/15/2005	945†	wet	1295
1225	#43 Hunting Lodge Road (private driveway)	8/16/2005	230	wet	
1225	#43 Hunting Lodge Road (private driveway)	8/17/2005	**10000* (96%)**	dry	
1225	#43 Hunting Lodge Road (private driveway)	7/20/2010	150	wet	216
1225	#43 Hunting Lodge Road (private driveway)	8/3/2010	310	dry	

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on Eagleville Brook with annual geometric means calculated (continued)

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
1697	N Eagleville Road adjacent to F-lot	7/13/2010	6900	dry	622
1697	N Eagleville Road adjacent to F-lot	7/20/2010	1100	wet	
1697	N Eagleville Road adjacent to F-lot	8/3/2010	190	Dry	
1697	N Eagleville Road adjacent to F-lot	8/10/2010	530	Dry	
1697	N Eagleville Road adjacent to F-lot	8/17/2010	10	wet	
1697	N Eagleville Road adjacent to F-lot	8/24/2010	1500	wet	
1697	N Eagleville Road adjacent to F-lot	8/31/2010	1400	dry	
1697	N Eagleville Road adjacent to F-lot	9/7/2010	1400	dry	
1697	N Eagleville Road adjacent to F-lot	9/14/2010	61	dry	
1697	N Eagleville Road adjacent to F-lot	9/21/2010	2600	dry	
1697	N Eagleville Road adjacent to F-lot	9/28/2010	1500	wet	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather geometric mean values for all monitoring stations on Eagleville Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1227	Upstream of Hillyndale Road	2005, 2010	4	10	56	294	29
1226	Upstream of Separatist Road	2005, 2010	5	12	262	451	296
1225	#43 Hunting Lodge Road (private driveway)	2005, 2010	3	2	632	319	1760
1697	N Eagleville Road adjacent to F-lot	2010	4	7	2755	397	1234

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gages at the Norwich Public Utility Plant in Norwich, CT.

Table 12: Cedar Swamp Brook Bacteria Data

Waterbody ID: CT3100-17_03

Characteristics: Freshwater, Class A, Potential Drinking Water Source, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **15%**

Single Sample: **66%**

Data: 2010 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from Station 1659 on Cedar Swamp Brook with annual geometric means calculated

Station Name	Station Location	Date	Result	Wet/Dry	Geomean
1659	Upstream of Hunting Lodge Road	5/5/2010	52	dry	**149* (15%)**
1659	Upstream of Hunting Lodge Road	5/11/2010	31	dry	
1659	Upstream of Hunting Lodge Road	5/18/2010	63	dry	
1659	Upstream of Hunting Lodge Road	5/25/2010	41	dry	
1659	Upstream of Hunting Lodge Road	6/1/2010	20	dry	
1659	Upstream of Hunting Lodge Road	6/8/2010	52	dry	
1659	Upstream of Hunting Lodge Road	6/15/2010	120	dry	
1659	Upstream of Hunting Lodge Road	6/22/2010	530	dry	
1659	Upstream of Hunting Lodge Road	6/29/2010	170	wet	
1659	Upstream of Hunting Lodge Road	7/6/2010	330	dry	
1659	Upstream of Hunting Lodge Road	7/13/2010	400	dry	
1659	Upstream of Hunting Lodge Road	7/20/2010	490	wet	
1659	Upstream of Hunting Lodge Road	7/27/2010	240	dry	
1659	Upstream of Hunting Lodge Road	8/3/2010	85	unknown	
1659	Upstream of Hunting Lodge Road	8/10/2010	560	unknown	
1659	Upstream of Hunting Lodge Road	8/17/2010	1100	unknown	
1659	Upstream of Hunting Lodge Road	8/24/2010	380	unknown	
1659	Upstream of Hunting Lodge Road	8/31/2010	150	unknown	
1659	Upstream of Hunting Lodge Road	9/7/2010	74	unknown	
1659	Upstream of Hunting Lodge Road	9/14/2010	120	unknown	
1659	Upstream of Hunting Lodge Road	9/21/2010	30	unknown	
1659	Upstream of Hunting Lodge Road	9/28/2010	**1200* (66%)**	unknown	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather geometric mean values for Station 1659 on Cedar Swamp Brook

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1659	Upstream of Hunting Lodge Road	2010	2	11	116	289	99

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gages at the Norwich Public Utility Plant in Norwich, CT.

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